BCS 6000B
BURNER CONTROL SYSTEM

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Attachments: Applicable Hauck Drawings

These instructions are intended to serve as guidelines covering the installation, operation, and maintenance of Hauck equipment. While every attempt has been made to ensure completeness, unforeseen or unspecified applications, details, and variations may preclude covering every possible contingency. **WARNING: TO PREVENT THE POSSIBILITY OF SERIOUS BODILY INJURY, DO NOT USE OR OPERATE ANY EQUIPMENT OR COMPONENT WITH ANY PARTS REMOVED OR ANY PARTS NOT APPROVED BY THE MANUFACTURER.** Should further information be required or desired or should particular problems arise which are not covered sufficiently for the purchaser's purpose, contact Hauck Mfg. Co.

A. GENERAL INFORMATION

The Hauck Burner Control System (BCS) provides burner management and temperature control for a single, pilot ignited burner firing on natural gas or oil. The spark ignited, gas fired pilot is interrupted after the main burner flame has been established. Flame supervision is provided by a Honeywell RM7890A1015 flame relay combined with a R7849A1023 amplifier module and C7027A UV detector(s).

This panel includes special provisions for adjustable valve characterization in order to reduce stack emissions. Reference section **F. VALVE CHARACTERIZATION** for details

A Programmable Logic Controller (PLC) supervises burner operation and provides three process control loops for material temperature, stack temperature, dryer draft. The PLC is coupled to a touchscreen display to supply the operator with system status and fault annunciation.

Two Honeywell UDC1000 series instruments are provided for temperature indication and over-temperature protection. The thermocouple of the **MATERIAL CONTROL** instrument is positioned to read the temperature of the material as it exits the dryer while the **STACK TEMPERATURE** instrument's thermocouple senses the temperature of the exhaust gases. The UDC1000 instruments display the process temperature and provide temperature inputs to the Programmable Logic Controller. The PLC, in turn, is electronically linked to the burner control motors to automatically adjust the burner firing rate and maintain process temperature near setpoint. The Operator can assign control of the burner to either thermocouple.

The alarm contact of the **STACK TEMPERATURE** instrument is used to shut down the burner if the preset high temperature limit is exceeded. The PLC also provides a high stack and material temperature alarms, which drive the burner to low fire if the alarm setpoints are exceeded..

CAUTION

The **STACK** alarm setpoint is factory set at 400 °F (204 C). If the system is equipped with a fabric dust collector (baghouse), consult the manufacturer for recommended baghouse temperature limitations. Refer to **Appendix E** for entering the desired alarm setpoints

B. RECEIVING AND INSPECTION

Upon receipt, check each item on the bill of lading and/or invoice to determine that all equipment has been received. Examine all parts to determine if there has been any damage in shipment. If equipment is to be stored prior to installation, provide a dry storage area.

IMPORTANT

For optimum use of the BCS panel, it is suggested that the drawings provided by Hauck be referred to for limit switch and valve installation and wiring. In the event that a recommended switch or valve is not used, it may be necessary to connect jumper wire(s) between appropriate terminals in the control panel or burner junction box. Such determination remains the responsibility of the Customer, based upon his application, accepted safe installation and operating procedures, and any applicable insurance guidelines or governmental regulations.

C. DRAWINGS AND SUPPLEMENTAL DATA

	BURNER SYSTEM		
	StarJet	**Eco-Star**	**Eco-StarII**
Tabletop Panel Assy.	CY7320	CY7320	CY7320
Drop-in Panel Assy.	CY7321	CY7321	CY7321
Wiring Diagram	CY7316	CY7316	CY7316
System Schematic	CY7345	CY7345	CY7315
External Component Wiring	CY7319	CY7317	CY7318

D. INSTALLATION

1. Locate the tabletop panel on a firm support in an area that is protected from the weather and free from vibration. The drop-in version is designed to install in an existing enclosure. Reference drawing CY7321 for required cutouts and mounting dimensions.

> **IMPORTANT**
>
> Operating specifications of 32 to 131 °F (0 to 55 °C), 30 to 95% relative humidity (non-condensing) should be considered in selecting a suitable location for the control panel.

2. Provide 120Vac single-phase grounded neutral power to the burner control panel. It is recommended that the Customer provide a master disconnect switch to interrupt power service to the panel. Maintain polarity as indicated on the drawings provided when connecting the main power source to the panel.
3. Install a heavy gauge (No. 12 AWG minimum) ground wire between the panel ground connector and "Earth" ground.
4. Wire the fuel valves, valve position limit switches and fuel pressure limit switches as shown on the external component wiring diagram.
5. Install the exhaust fan flow limit switch in the dryer exhaust duct as shown in **Appendix F.** Wire the normally open contact of the exhaust flow limit to the appropriate terminals in either the burner junction box or the BCS control panel.
6. Install the stack temperature thermocouple in the dryer exhaust duct to sense exhaust gas temperature. See **Appendix G.** for installation instructions.
7. Install a Hauck Rapid Response material temperature thermocouple in the material discharge chute to sense the temperature of the material leaving the dryer. See **Appendix H.** for recommended installation.
8. Connect the thermocouples to the appropriate terminals in the BCS control panel using thermocouple cable of the same type as the Material and Stack thermocouples.

IMPORTANT

Thermocouple cables must be separated from AC power and control wiring to avoid interference and nuisance shutdowns. Observe polarity when making thermocouple connections. Regardless of thermocouple type, the red wire is always negative.

9. A pressure tap for the dryer draft transmitter should be located in the 10 o'clock or 2 o'clock position on the dryer breech. Locate the tap midway between the outer edge of the breeching and the outer edge of the combustion chamber or shell. Cut a hole to accommodate a 1" pipe coupling angled downward approximately 30 degrees.

10. Mount the draft transmitter on a vibration free support, shielded from direct flame radiation. The operating temperature range is -20 to 180°F. Connect the transmitter manifold to the LOW pressure tap and leave the HIGH tap open to atmosphere as a reference. The open tap must be shielded from wind and other disturbances and should not be in a position to collect dirt or water. The manifold moisture drain should be positioned vertically down.

11. Install the flame scanner(s) on the burner and wire them to the appropriate terminals in the burner junction box. Reference burner instructions for scanner installation details.

12. Refer to the external component wiring diagram for interconnection between the burner junction box and the BCS panel terminal strips.

IMPORTANT

The flame scanner, draft transmitter, and control motor position feedback signals should be run in a separate harness from the burner junction box to the BCS control panel. These cables may be run along with thermocouple cables but must be separated from all other AC power and control wiring. Note that if shielded cable is used, only one end of the cable shield should be grounded. Use one of the ground terminals in the BCS control panel for this purpose.

13. Set the purge timer, 1TR, for the required purge time.

IMPORTANT

Before igniting the burner, the dryer must be purged to remove possible accumulation of combustible gases. **A MINIMUM OF FOUR COMPLETE AIR CHANGES MUST BE SUPPLIED.** Multiply the total system volume (dryer, baghouse and exhaust ducts) in cubic feet by four. Divide this value by the burner air capacity in cubic feet per minute. The result will be the required purge time in minutes.

14. Be sure that all equipment and components have been installed in accordance with the manufacturer's instructions.

15. Verify all wiring and tighten connections.

16. Clean all traps and filters.

17. Check all fuel and air supply lines for leaks.

18. Verify all pressure settings.

E. ADJUSTMENTS and FINAL CHECKOUT:

Record all settings on the **CONFIGURATION RECORD SHEET** provided in **Appendix B.**

IMPORTANT

The burner control motors incorporate a position feedback slidewire. A 5 Vdc supply voltage from the panel is connected to the slidewires in order to generate 0 to 5 Vdc position feedback signals for the PLC. The following control motor calibration procedure must be performed before operating the burner for the first time. **RECALIBRATE ANNUALLY OR WHENEVER A CONTROL MOTOR IS SERVICED OR REPLACED.**

The EZ-S8C-F touchscreen provides access to the system operating parameters. Note that touching any of the numeric displays with white text on a blue background will provide a pop-up keypad for numeric entry. The use of a pencil eraser, wooden or plastic stylus is recommended for more precise selection. In order to extend the life of the display, it has been programmed to enter a screen saver mode 5 minutes after the burner is stopped. Simply touch the display to de-activate the screen saver.

MOTOR CALIBRATION & SETUP Screen

Press the MAIN MENU key to access the menu screen then press the MOTOR CALIBRATION & SETUP button to display the calibration screen.

MOTOR CALIBRATION

- The control motor DEADBAND settings determine the allowable deviation of actual control motor position from setpoint without corrective action by the motor control outputs (minimum 0.5%, maximum 5.0%, typically set at 1.0% for fuel and 1.5% for air). These parameters should be set as low as possible without causing the control motors to "hunt" excessively. Touch the numeric displays and use the popup keypad to enter a deadband setting for each motor.
- Press the ZERO button to drive all control motors closed for calibration and record the slidewire feedback signals. Confirm that all motors have reached their low fire positions before beginning span calibration.
- Press the SPAN button to drive the motors open and record the resulting feedback signals. Verify that all motors have fully opened before pressing the OFF button to store the span values and end motor calibration.

BURNER OPERATING PARAMETERS

- Set the **BURNER OUTPUT LIMIT** at 100.0% for normal operation. This value may need to be lowered to accommodate system limitations.
- If the optional gas flow display and totalizer is installed, set the **GAS PRESSURE** to match the pressure, in ounces, measured just upstream of the gas orifice flange assembly.

TEMPERATURE DISPLAY

- If the Material and Stack temperatures displayed on the touchscreen are significantly different from the UDC1000 instrument displays, a positive or negative **BIAS** value may be entered for each instrument.

CONTROL LOOP TUNING Screen

After setting and recording all parameters on the motor calibration & setup screen, press MAIN MENU key to return to the menu screen then select the CONTROL LOOP TUNING button to display the loop tuning screen. This screen is used to enter tuning constants for each of the three PID control loops. MATERIAL or STACK temperature control may be selected on this screen. Manual control of the burner firing rate and exhaust damper control motors is also provided.

- Enter a GAIN setting for each loop. Note that Gain = 100/Proportional Band% or Proportional Band% = 100/Gain. For example a Gain of 5 is equivalent to a Proportional Band setting of 20%
- Enter a DEADBAND setting (degrees F for temperature and inches of water column for draft) for each loop. This value should be as small as possible without excessive "hunting" by the control actuators.
- Enter a RESET setting for the Material and Stack control loops. Note that Reset is expressed in minutes per repeat rather than repeats per minute. Therefore, the smaller the setting the more frequently reset action will be repeated.
- Enter a RATE setting (seconds) if desired for Material and Stack control. Note that Rate tends to de-stabilize the control and may be left at zero.
- Enter CYCLE time settings (seconds) for the Draft control loop. Note that this loop provides duplex time proportional control outputs for the exhaust damper actuator and has separate Open and Close cycle times similar to the DPS instrument it replaces.

AUTOTUNE

The Material, Stack and Draft control PID loops are equipped with an AUTO TUNE button. Please note the following before initiating the auto tune procedure:

- The process should be stabilized and operating under normal conditions before beginning the auto tune procedure. Do not change material feed rate, mix or setpoint while auto tune is in progress.
- Only one loop at a time may be tuned.
- The loop must be in AUTO.
- The loop will be cycled between 100% and 0% three times during the course of the auto tune procedure. Obviously, this will cause significant swings in temperature and/or dryer draft.
- Auto tune may be interrupted, if necessary, by placing the control loop in manual.
- The resulting **GAIN, RESET** and **RATE** parameters (**GAIN** only for draft control) will be automatically updated when the sequence is completed.
-

RUN MENU Screen

After all loop tuning settings have been recorded return to the MAIN MENU then press RUN MENU to display the run menu screen. This screen provides control mode selection, startup ramp settings for automatic temperature control, low fire drive alarm settings, and draft control setpoints.

DRAFT CONTROL

- Enter a draft control PURGE SETPOINT for use during the burner purge sequence. Set this value higher than the normal draft setpoint to prevent dusting as the air damper drives open for purge.
- Enter LOW FIRE and HIGH FIRE SETPOINTS for draft control. The draft setpoint will automatically ramp from the low fire to the high fire setpoint as the burner firing rate increases.
- Enter a TRANSFER DELAY time in seconds to set the length of time after burner ignition is initiated that the purge setpoint remains active for draft control before transferring to the normal operating setpoint.
- To accommodate variations in material moisture or composition and prevent nuisance shutdowns, provisions are made for automatic draft setpoint increase. The PLC senses "puffs" in the dryer drum and automatically increases dryer draft if a set number of puffs occurs within a ten second time window. Set the desired increase via the INCREASE DRAFT BY _.__"WC display and enter values in the IF DRAFT DROPS BELOW _.__"WC and MORE THAN __ TIMES fields. For example, with settings of 0.02"WC, 0.10"WC and 2 Times, the dryer draft setpoint would be increased by 0.02"WC if dryer draft dropped below 0.10"WC more than 2 times within a 10 second interval due to puffing. Note that the draft control setpoint returns to its original setting when the burner is shut off.

TEMPERATURE CONTROL

- Select MATERIAL or STACK temperature control.
- Set a START AT and RAMP AT percentage for startup. If automatic temperature control is selected, the burner will drive to the START AT __% setting as soon as the main flame has been established. The control output will then begin to RAMP AT __% per minute until the output of the selected temperature control loop is equal to or less than the ramp output. The control loop will then assume control of the burner firing rate.
- The burner will be forced to low fire if the stack temperature exceeds the LOW FIRE DRIVE IF STACK GREATER THAN __ F. setting.
- Likewise, the burner will be forced to low fire if material temperature exceeds the LOW FIRE DRIVE IF MATERIAL GREATER THAN __ F. setting.

LINKAGE SETUP

After motor calibration is completed and system setup parameters have been set, press the LINKAGE SETUP button to enter the linkage setup mode. The fuel and air control motors will be released from low fire and respond to the output of the temperature control loop. Return to the MAIN screen and place the temperature control loop in MANUAL. Drive the motors as required to adjust fuel and air control valve linkages. Confirm all linkage adjustments and insure that control arms and linkage rods are tight, then return to the RUN MENU screen and select either MATERIAL or STACK control to return to normal operation.

Verify that all low fire limit switch contacts are closed (Slot 2, input 5) is ON when the burner is at 0% and OFF when the burner leaves low fire. Refer to the burner operating instructions for switch adjustment.

Time and Date Setting

Simultaneously press the upper left and lower left corners of the touchscreen to enter the screen setup mode then select **CLOCK** to access the time and date settings. Use the keypad to enter the desired value then press **Sec**, **Min**, **Hr**, **Day**, **Mon**, or **Yr** as applicable. For example, to set the month to September, use the keypad to enter 9, then press **Mon**. Use the **EXIT** buttons to return to normal operation.

F. ELECTRONIC VALVE CHARACTERIZATION

WARNING

Adjustment of this equipment by unqualified personnel can result in fire, explosion, severe personal injury, or even death. This procedure requires the use of a stack analyzer to properly adjust air/fuel ratio and optimize burner performance. It is intended for qualified personnel, familiar with combustion systems and the interpretation of stack emission readings. Electronic Valve Characterization is designed to provide for minor adjustments to the air control valve position only. The low fire start position and overall valve stroke must be set by adjustment of the valve/motor linkage.

To facilitate burner setup and optimize emissions, the BCS6000 system has been equipped with Electronic Valve Characterization (EVC). This feature provides for creation of a separate motor response curve for the air control motor. Regardless of fuel selection, the fuel control motor directly follows the heat demand output of the temperature controller. For example, 15% output from the temperature controller will result in the fuel control motor driving 15% open. Meanwhile, the air control motor will follow a separate curve established by setting seven characterization (bias) points (see **Figure 1)**

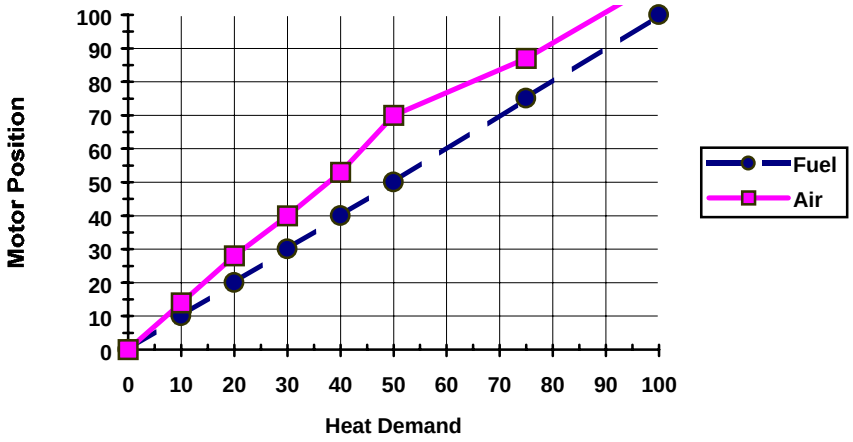


Figure 1: Example of Air bias settings

BIAS POINT ADJUSTMENT:

Before firing the burner, place the **FUEL SELECTOR** switch in the **OIL** position, and then press the MAIN MENU button followed by the OIL or LP FIRING BIAS POINTS button. Match all seven air bias points to the fuel settings. Press MAIN MENU again to return to the menu screen then change the fuel selection to GAS. Now select the GAS FIRING BIAS POINTS button and again verify that all seven air bias points are set to match the fuel points.

Setup an analyzer to monitor stack or drum emissions. With the burner firing in manual at approximately 10% output, select the bias point setting screen. Allow the analyzer readings to stabilize, then increase or decrease the air input, if required. Make small adjustments and allow readings to settle after each change. Increase the burner firing rate to approximately 20% and repeat the above adjustment procedure. Continue for the 30%, 40%, 50%, 75% and 100% points or extrapolate settings by plotting them on the chart in **Figure 2**. Record the resulting settings in the table provide in **Appendix B**. Press the MAIN button to exit and return to normal display.

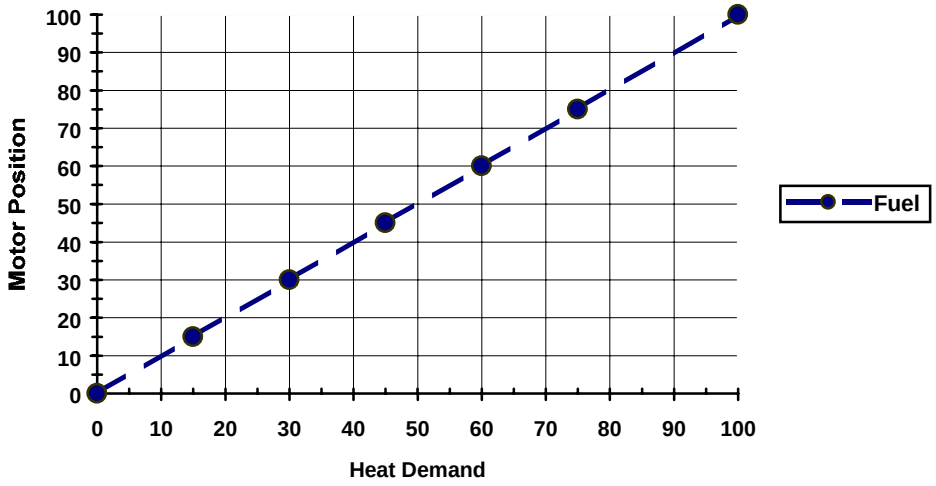


Figure 2: Blank chart for plotting bias settings.

G. PANEL OPERATION

1. Open all manual shutoff valves to supply air and fuel to the pilot and burner systems.
2. Move the panel **POWER** switch to **ON** and verify that the **FUEL SELECTOR** switch is in the desired position.
    a. The temperature instruments, touchscreen display, flame relay and PLC will perform their self-test procedures.
    b. The burner control motors will drive to their low fire position.
    c. The **RESET** indicator will come on.
    d. A "*BURNER STOPPED...*" message will be displayed.
3. Start the exhaust fan, combustion air blower, and all other equipment required for plant operation. After the exhaust fan limits have closed, the **HELD CLOSED** indicator of the draft control will disappear and the exhaust damper will be released to control dryer draft.
4. Select **MATERIAL** or **STACK** control and verify the setpoints of both.
5. If all system limits are closed, "*PRESS RESET TO START PURGE*" will appear in the message box.

6. Momentarily press the **RESET** button to initiate the system purge sequence.
    a. An "*OPENING AIR VALVE"* message will appear as the burner air control motor drives open.
    b. After the air control motor has opened more than 50%, purge timer, 1TR, will be energized and begin timing and a *"PURGING".* Message will appear.
7. After the purge delay has been completed, 1TR timer will actuate and a " *LOW FIRE DRIVE*" message will appear as the air control motor drives closed to prepare for pilot ignition.
8. When all motors have reached their low fire start position and the burner low fire limit switches have closed; the **START** pushbutton will flash and a "*READY TO START*" message will be displayed.
9. Momentarily press the **START** pushbutton to begin the burner ignition sequence.
    a. The RM7890A flame relay will be energized and a ten second pilot trial for ignition time will begin.
    b. The ignition transformer and pilot solenoid valves will be energized and an "*IGNITING PILOT*" message will appear.
10. If a satisfactory pilot flame is detected by the UV scanner:
    a. The **START** pushbutton will stop flashing and remain on and a *"PILOT ON"* message will be displayed.
    b. Flame signal strength (0-5Vdc) will be displayed on the flame meter. Minimum acceptable signal is 0.5Vdc.
    c. Power will be supplied to the main fuel valves.
11. Three seconds after the pilot flame has been recognized:
    a. The ignition transformer will be de-energized.
    b. A "*MAIN FUEL VALVES ENERGIZED*" message will appear.
12. As soon as the main fuel valve has opened and the valve open limit switch has closed:
    a. Pilot timer, 2T, will be energized and the 10 second main flame trial for ignition time will begin.
    b. A *"MAIN FLAME TRIAL FOR IGNITION"* message will be displayed.
13. After the trial for ignition timer has completed its delay:
    a. The pilot solenoid valves will be de-energized and the pilot will go out.
    b. The burner control motors will be released from low fire.
    c. A *"MAIN FLAME ON..."* message will be displayed.
14. Start material flow to the dryer. If the temperature control loop is in **AUTO**, the burner will drive to the START AT percentage then begin ramping at the RAMP AT rate set on the RUN MENU screen. If **MANUAL** temperature control has been selected, use the **INC** and **DEC** buttons to manually control the burner firing rate or press the **OUTPUT** display and enter the desired output value via the popup keypad.

15. Note that the burner may be forced to low fire at any time by pressing the **DRIVE TO LOW FIRE** button.
    a. The button will be highlighted and *"LOW FIRE SELECTED"* will appear in the message box.
    b. Press the button a second time to release the burner from low fire.
16. To terminate burner operation, press the **STOP** pushbutton.
    a. The Honeywell RM7890A flame relay and all fuel valves will be de-energized.
    b. The air and fuel control motors will drive closed.
    c. A*"BURNER STOPPED..."* message will be displayed and the **RESET** indicator will come on.

H. TROUBLESHOOTING

Use the HELP screens on the touch screen or refer to the following table.

MESSAGE	DIAGNOSTICS
CONTROL MOTOR CALIBRATION REQUIRED	The difference between the Zero and Span feedback values of each motor must be greater than 3300. Verify that the motors travel full stroke during the motor calibration procedure.
FUEL CONTROL MOTOR FAULT	* Indicates that the fuel control motor has failed to respond to the motor positioning output signals of the PLC. Check fuse 5 on the printed circuit board. Also monitor slot 4 outputs 4 and 5 and relays R6 and R7.
AIR CONTROL MOTOR FAULT	* Same as above for the air control motor. Check fuse 45 on the printed circuit board. Monitor slot 4 outputs 6 and 7 and relays R8 and R9.
EXCESS FUEL FAULT	* The control algorithm does not normally allow the fuel motor position to be greater than the theoretical air position. A fuel motor malfunction may cause this condition to occur.
CHECK PURGE AIR LIMITS & MAIN FUEL VALVE PROOF OF CLOSURE SWITCHES	Monitor slot 2 input 7, terminals 24 thru 24E. This message appears if the purge air pressure limit, exhaust damper open limit, or any of the fuel valve proof of closure switches fails to close.
CHECK LOW FIRE LIMITS	Monitor slot 2 input 5. Verify that all low fire limit switches are closed (120Vac on terminal 21) when the control motors are in the low fire start position.
MAIN FUEL VALVE FAULT	Monitor slot 2 input 6. The valve open switch in the main fuel valve must close within 20 seconds after the pilot flame has been recognized.
HIGH STACK. TEMPERATURE: LOW FIRE HOLD	Check the low fire alarm setting on the RUN MENU screen. The burner will be held at low fire until stack temperature falls below the alarm setpoint
HIGH MATL. TEMPERATURE: LOW FIRE HOLD	Same as above for the low fire drive material temperature alarm. The burner will be held at low fire until material temperature falls below the alarm setting.
FLAME FAILURE	Indicates that the flame relay has locked out due to a flame failure. Check burner setup.
FLAME RELAY RESET REQUIRED	Monitor slot 1 input 6 and the ALARM indicator of the Honeywell flame relay. This fault normally indicates that the pilot has failed to ignite within the trial for ignition period. Verify that air, fuel and spark are being supplied to the pilot. Other possibilities include: 1. Premature flame signal. If the flame meter indicates presence of a flame before the ignition sequence is started, the flame relay will lockout and the RESET indicator will come on. Check for fire in the dryer drum or for a failed UV scanner. 2. Bad or missing ground. The Honeywell RM7890 requires a 120Vac grounded neutral power supply for proper operation. 3. Flame amplifier failure. The R7849A1023 flame amplifier may need to be replaced.

MESSAGE	DIAGNOSTICS
EXHAUST FAN FAULT	Monitor slot 2 input 0. Check the exhaust fan flow switch (power on terminal 12) and the exhaust fan motor starter interlock (power on terminal 13).
SECONDARY AIR INTERLOCK FAULT	Monitor slot 3 input 1. Verify that the burner blower is running and check the secondary air starter interlock (power on terminal 14).
LOW SECONDARY AIR PRESSURE	Monitor slot 2 input 1. Verify that the secondary air pressure switch is made (power on terminal 16).
PRIMARY AIR INTERLOCK FAULT	Monitor slot 3 input 2. For StarJet and EcoStar systems that use a primary air blower for atomization, verify that the blower is running and check for power on terminal 15. Note that for EcoStar II systems this limit is only required when OIL or LP firing is selected.
LOW PRIMARY AIR PRESSURE	Monitor slot 3 input 3. For StarJet and EcoStar systems verify that the primary air or compressed air pressure switch is made (power on terminal 15A). Note that for EcoStar II systems this limit is only required when OIL or LP firing is selected.
LOW GAS PRESSURE	Monitor slot 3 input 4. Verify that the manual gas shutoff valve is open and that the low gas pressure switch is made (power on terminal 16A).
HIGH GAS PRESSURE	Monitor slot 3 input 0 and the high gas pressure switch (power on terminal 17).
LOW OIL or LP PRESSURE	Monitor slot 3 input 5. Verify that the manual shutoff valve is open and that the low pressure switch is made (power on terminal 17A).
LOW OIL TEMPERATURE	Monitor slot 2 input 2. For heavy oil systems, verify that the oil heater is operating and the oil temperature switch is made (power on terminal 18).
HIGH STACK TEMPERATURE	Monitor slot 2 input 3. Check for power on terminals 25 and 26. Observe the display and OUT indicator of the stack temperature instrument. A full scale reading (842 F or 450 C) indicates an open TC or broken wire
REPLACE SCREEN BATTERY	Indicates low touchscreen battery voltage. Replacement batteries are available from Automation Direct (part no. EZ-BAT). Consult the EZTouch Hardware User Manual for battery replacement instructions..
REPLACE PLC BATTERY	Indicates low PLC battery voltage. The battery compartment is located in the CPU. A replacement battery is available from Hauck (part no. 62311) or Automation Direct (part no. D2-BAT-1).

*****The control motor and excess fuel faults all indicate possible problems with the burner control motors or the position feedback circuits. Silence the alarm horn and make note of the motor position values displayed on the MOTOR CALIBRATION screen, then press the **ALARM SILENCE** button a second time to reset the fault. Shut off the burner verify that all control motors drive to their **ZERO** and **SPAN** positions and that the feedback signals change smoothly as the motors drive. If not, check fuse 99 and verify that 5Vdc exists between terminals 82 (+) and 81 (-). Also, check fuses 5 and 45 on the printed circuit board.

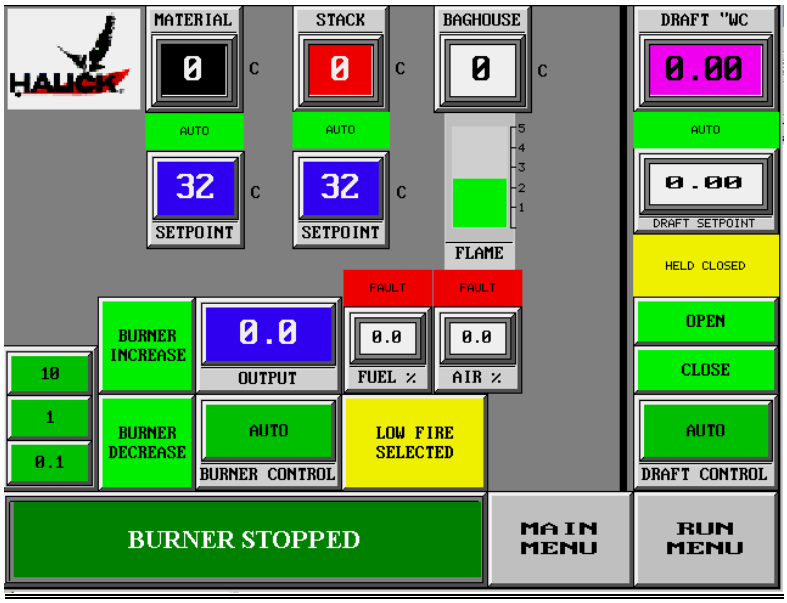
ALARM HISTORY Screen

An alarm history screen is also provided for use as a troubleshooting guide. From the MAIN MENU screen press ALARM HISTORY to view a list of the last 99 logged events and the order in which they occurred. Page up or down, if necessary, to view the entire list. Use the LINE UP

or LINE DOWN button to select a particular item then press DETAILS to view the time and date information. Note that *"FLAME ON"* and *"BURNER STOPPED"* are included in the alarm list for monitoring purposes even though they are not alarm conditions.

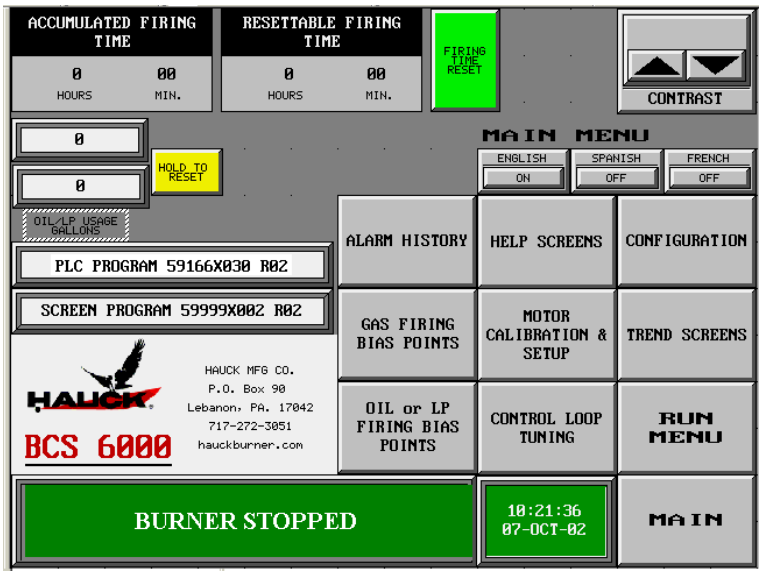
The ALARM COUNT screen shows how many times each alarm has occurred.

APPENDIX A: OPERATOR INTERFACE SCREENS



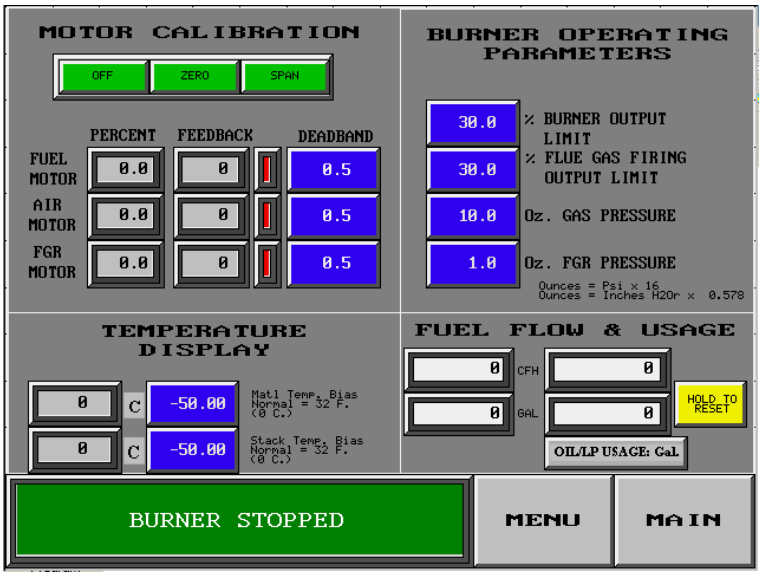
MAIN SCREEN

This screen displays overall system status and is the default screen on system power-up. It provides **AUTO/MANUAL** control selection and setpoint (**SP**) inputs for the temperature control loops. Note that the message box in the lower left corner of the screen appears on <u>all</u> screens to provide the operator with system status messages. The **MAIN MENU** and **RUN MENU** buttons provide quick access to other screens. Indicators below the **MATERIAL** and **STACK** temperature readouts indicates which thermocouple is being used for control.



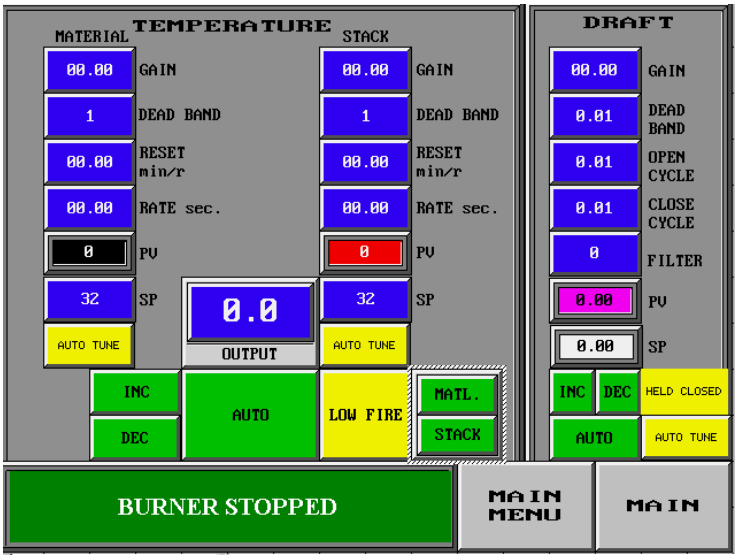
MAIN MENU SCREEN

Used to access other screens. Also provides language selection, display contrast adjustment, accumulated and resettable (daily) firing times. If the system is equipped with the fuel flow option, totalized fuel usage is also displayed. Record the PLC and screen program numbers that appear on this screen as they will be required if service is requested.



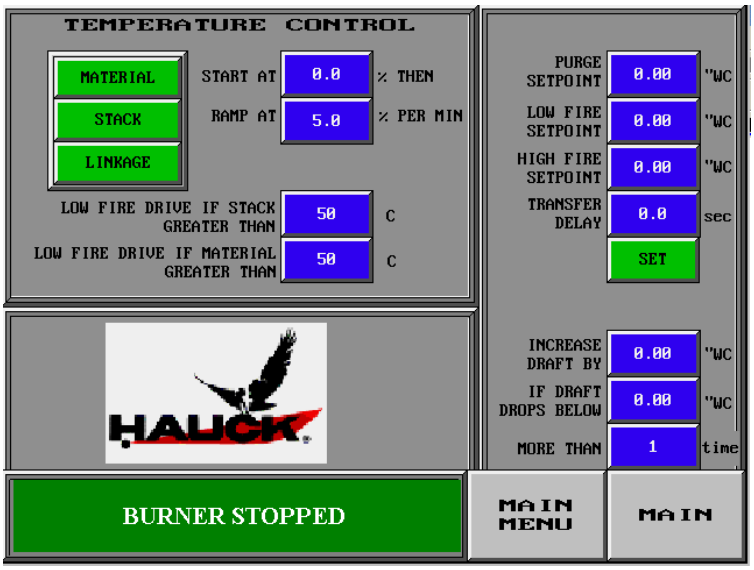
MOTOR CALIBRATION & SETUP

Reference **Section E.** Used to ZERO and SPAN the burner control motors and to enter motor deadband settings. Provides numeric inputs for burner firing rate limits, gas pressure correction and temperature bias settings.



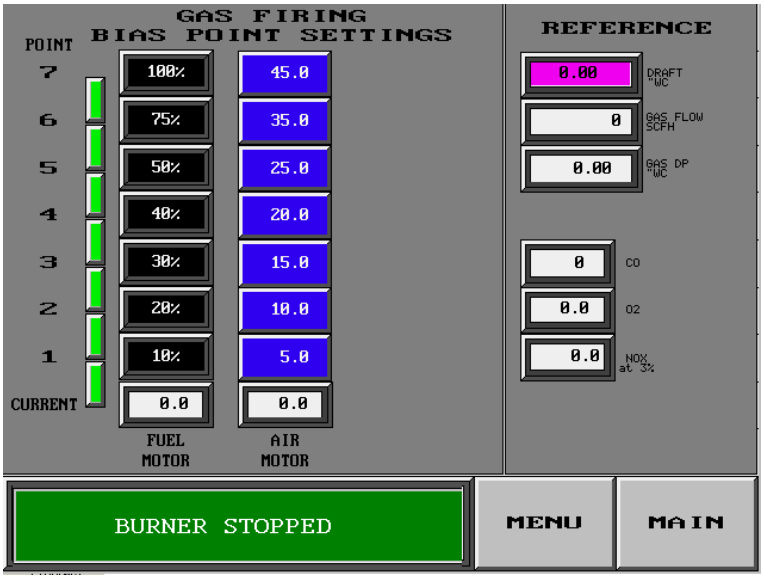
CONTROL LOOP TUNING

Reference **Section E.** Used to set PID control loop tuning constants for the Material and Stack temperature control and Dryer Draft control. Also provides temperature setpoint inputs, **AUTO/MANUAL** selection, and **AUTO TUNE** selection.



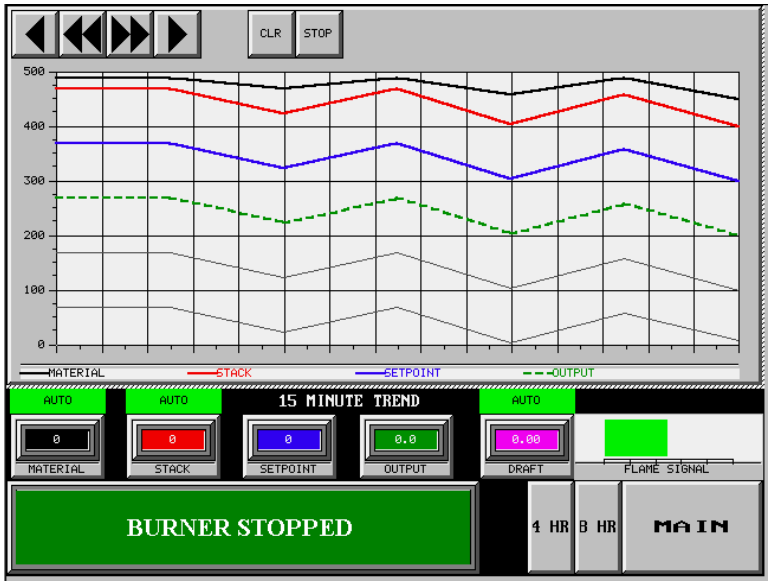
RUN MENU

Reference **Section E** Used to set the burner startup percentage and ramp rate for automatic temperature control. Also provides for low fire drive alarms and draft setpoint inputs, selection of control mode and parameters for automatic draft increase control.



BIAS POINT SETTINGS

Reference **Section F** Two separate screens (GAS and OIL/LP) are provided setup the electronic valve characterization for the air valve. It provides inputs for air valve position for each of seven fuel valve positions (10, 20, 30, 40, 50, 75 and 100%). It also displays pertinent data to aid in burner setup.



TREND

Three separate trend screens provide 15 minute, 4 hour and 8 hour trends of Material temperature; Stack temperature, Setpoint and burner firing rate.

APPENDIX B: CONFIGURATION RECORD

MAIN MENU SCREEN

PLC PROGRAM: _____
SCREEN PROGRAM: _____

MOTOR CALIBRATION & SETUP SCREEN

MOTOR	ZERO	SPAN	DEADBAND
FUEL			
AIR			

BURNER OUTPUT LIMIT: _____
GAS PRESSURE: _____ oz.
MATERIAL TEMPERATURE BIAS: _____
STACK TEMPERATURE BIAS: _____

CONTROL LOOP TUNING SCREEN

	MATERIAL	STACK	DRAFT
GAIN			
DEADBAND			
RESET			
RATE			XXXXXXXX
OPEN CYCLE	XXXXXXXX	XXXXXXXX	
CLOSE CYCLE	XXXXXXXX	XXXXXXXX	
SETPOINT			XXXXXXXX

RUN MENU SCREEN

START AT _____ % THEN
RAMP AT _____ % PER MIN.
LOW FIRE DRIVE IF STACK GREATER THAN _____
LOW FIRE DRIVE IF MATERIAL GREATER THAN _____
PURGE SETPOINT: _____ “WC
LOW FIRE SETPOINT: _____ “WC
HIGH FIRE SETPOINT: _____ ”WC
SETPOINT TRANSFER DELAY: _____ sec.
REDUCE DRAFTBY _____ “WC
IF DRAFT DROPS BELOW _____ “WC
MORE THAN _____ TIMES

BIAS POINTS

Firing Mode	**Settings**	**1 10%**	**2 20%**	**3 30%**	**4 40%**	**5 50%**	**6 75%**	**7 100%**
Gas	Air At:							
Oil or LP	Air At:							

APPENDIX C: RECOMMENDED SPARE PARTS

PART NO.	QTY.	DESCRIPTION
56648	1	Flame relay, Honeywell RM7890A1015
56650	1	Amplifier, Honeywell R7849A1023
20579	2	Scanner, Honeywell C7027A1049
58485	4	Relay, SPDT, Idec RH1B-U-AC120V
17292	1	Relay, 3PDT, P&B KUP 14A35 or equal
46311	1	Relay, solid state, Crydom 1210 w/6.8k resistors.
61961	1	Timer, DPDT Purge, ATC #407B-100-F3K
300340	1	Timer, 10 second N-C delay on make, SSAC TIS4-4B-1-10
61818	1	Power supply, 24Vdc, Automation Direct FA-24PS
53763	1	Regulator, 5Vdc, MC7805ACT
58762	5	Fuse, 2A, 1/4 x 1-1/4, Buss MDA-2
58763	5	Fuse, 5A, 1/4 x 1-1/4, Buss MDA-5
55167	5	Fuse, 7A, 1/4 x 1-1/4, Buss MDA-7
48044	5	Fuse, 10A, 1/4 x 1-1/4, Littlefuse 312010
400429	1	Module, CPU, Automation Direct D2-250, with operating program installed
62311	1	Battery, Automation Direct, D2-BAT-1
58481	1	Module, 8-point AC input, Automation Direct D2-08NA-1
58479	1	Module, 8-point relay output, Automation Direct D2-08TR
63319	1	Module, 8-point voltage input, Automation Direct F2-08AD-2
300181	1	Operator interface touch screen, Automation Direct EZ-S8C-F
43508	1	Material thermocouple, Hauck TC100A-J
43868	1	Stack thermocouple, Hauck TC200A-J

APPENDIX D: DL250 PROGRAMMABLE CONTROLLER

VENDOR: Automation Direct (800) 633-0405

BASE: 9-Slot base
Hauck part number 58484 / Automation Direct model number D2-09B

CPU: Central processing unit
Hauck part number 400429 / Automation Direct model number D2-250

BATTERY Hauck part number 62311 / Automation Direct model number D2-BAT-1

SLOT 0: 8-Point analog voltage input module
Hauck part number 63319 / Automation Direct model number F2-08AD-2

Input	Wire	Function
1	92	0-5Vdc Material temperature from UDC1000 instrument
2	93	0-5Vdc Stack temperature from UDC1000 instrument
3	94	1-5Vdc from dryer draft transmitter
4	91	0-5Vdc flame signal from RM7890A flame relay
5	83	0-5Vdc fuel control motor position
6	85	0-5Vdc air control motor position
7	84	Spare
8	88	1-5Vdc from optional baghouse outlet temperature transmitter
24V	99	24Vdc supply
0V	81	Analog reference

SLOT 1: 8-Point AC input module
Hauck part number 58481 / Automation Direct model number D2-08NA-1

Input	Wire	Function
X20	28	RESET pushbutton
X21	23	ALARM SILENCE pushbutton
X22	38	START pushbutton
X23	60	OIL selected, from fuel selector switch
X24	36	STOP pushbutton (Normally closed)
X25	56	Flame on, from flame relay
X26	58	Reset required, from flame relay
X27	48	Spare.
COM	L2	AC Neutral

SLOT 2: 8-Point AC input module
Hauck part number 58481 / Automation Direct model number D2-08NA-1

Input	Wire	Function
X30	13	Exhaust fan limits
X31	16	Secondary air interlock
X32	18	Low oil temperature
X33	26	Stack temperature limit
X34	54	Purge complete from 1TR timer.
X35	21	Low fire limit switches
X36	43	Main fuel valve open
X37	24	Purge air and main fuel valve closed limits
COM	L2	AC Neutral

SLOT 3: 8-Point AC input module
Hauck part number 58481 / Automation Direct model number D2-08NA-1

Input	Wire	Function
X40	17	High gas pressure limit
X41	14	Secondary air motor starter interlock
X42	15	Primary air motor starter interlock
X43	15A	Primary air pressure switch
X44	16A	Low gas pressure
X45	17A	Low oil pressure
X46	75	Opt switch
X47	76	Spare
COM	L2	AC Neutral

SLOT 4: 8-Point relay output module
Hauck part number 58479 / Automation Direct model number D2-08TR

Output	Wire	Function
Y0	63	Purge relay, R2
Y1	64	Run relay, R3
Y2	65	Pilot scanner relay, R4
Y3	66	Pilot relay, R5
Y4	67	Fuel motor increase relay, R6
Y5	68	Fuel motor decrease relay, R7
Y6	69	Air motor increase relay, R8
Y7	70	Air motor decrease relay, R9

SLOT 5: 8-Point relay output module
Hauck part number 58479 / Automation Direct model number D2-08TR

Output	Wire	Function
Y10	49	Alarm horn
Y11	20	START indicator
Y12	71	Spare relay, R10
Y13	27	RESET indicator
Y14	40	Draft increase relay, R13
Y15	42	Draft decrease relay, R14
Y16	74	Spare relay, R11
Y17	73	Spare relay, R12

SLOT 6: *Optional* 8-Point analog current input module
Hauck part number 300344 / Automation Direct model number F2-08AD-1

Input	Wire	Function
1	96	4-20mA from optional gas differential pressure transmitter
2	97	Spare
3	95	Spare
4	98	4-20mA from optional oil or LP flow transmitter
5	101	Spare
6	102	Reserved for Hauck Service
7	103	Reserved for Hauck Service
8	104	Reserved for Hauck Service
24V	99	24Vdc supply
0V	81	Analog reference

APPENDIX E: UDC1000 SERIES LIMIT INSTRUMENTS

Hauck part number 300003 Honeywell model DC100L-1-1-7-0-1-0-0-0

Two Honeywell UDC1000 series instruments are provided for temperature indication and over-temperature protection. Each instrument receives a thermocouple input and provides a 0 to 5Vdc temperature signal to the PLC. The thermocouple of the **MATERIAL CONTROL** instrument is positioned to read the temperature of the material as it exits the dryer while the **STACK TEMPERATURE** instrument's thermocouple senses the temperature of the exhaust gases. The alarm contact of the **STACK TEMPERATURE** instrument is used to shut down the burner if the preset high temperature limit is exceeded.

Figure 1 shows the front face of the UDC100L instrument.

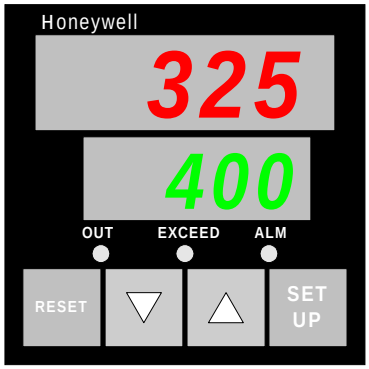


Figure 1.

Upper Display: Normally displays process temperature. Also displays parameter values or selections when in the set up mode.

Lower Display: Shows value of set point. Also displays function groups and parameters when in the set up mode.

OUT: Illuminated when the alarm contact is de-energized after the alarm setpoint has been exceeded.

EXCEED: Illuminated when process temperature is greater than the alarm setpoint.

ALM: Flashes when an abnormal condition such as a broken thermocouple exists.

RESET: Used to reset the alarm contact and extinguish the **OUT** indicator after the setpoint has been exceeded.

▼: Used to decrease the setpoint or configuration values.

▲: Used to increase the setpoint or configuration values.

SET UP: Used in conjunction with the ▲ key to enter the set up and configuration modes. Also used to advance through the parameters

CONFIGURATION

The instruments are factory set for a type J thermocouple with a range of 32 to 842 degrees Fahrenheit. Use the following procedure to change thermocouple type or temperature units if required. Detailed information is given in the vendor literature supplied with the control panel.

Immediately after powering the instrument, hold the **SET UP** and ▲ keys simultaneously for approximately 5 seconds to enter the configuration mode. **inPt** will appear in the lower display and **1418** should appear in the upper display.

Use the **SET UP** key to step through the configuration parameters and the ▲ and ▼ keys to change values if necessary. The upper display will flash after a value has been

changed and the **RESET** key must be pressed to accept the change. Momentarily press the **SET UP** and ▲ keys again to exit the configuration mode.

	Fahrenheit		Centigrade	
	Type J	Type K	Type J	Type K
Lower Display	Upper Display	Upper Display	Upper Display	Upper Display
inPt	1418	6727	1417	6726
CtrL	Hi	Hi	Hi	Hi
ALA1	P_hi	P_hi	P_hi	P_hi
ALA2	nonE	nonE	nonE	nonE
A1_d	USE2	USE2	USE2	USE2
rEcP	USE3	USE3	USE3	USE3
CJC	EnAb	EnAb	EnAb	EnAb
Loc	read only	read only	read only	read only

CHANGING THE SET POINT

Press the **SET UP** and ▲ keys simultaneously. **0** will appear in the upper display and **ULoc** will appear in the lower display.

Press **SET UP** key one time to display **SP** in the lower display and the current setpoint value in the upper display.

Use the ▲ and ▼ keys to change the setpoint.

CAUTION

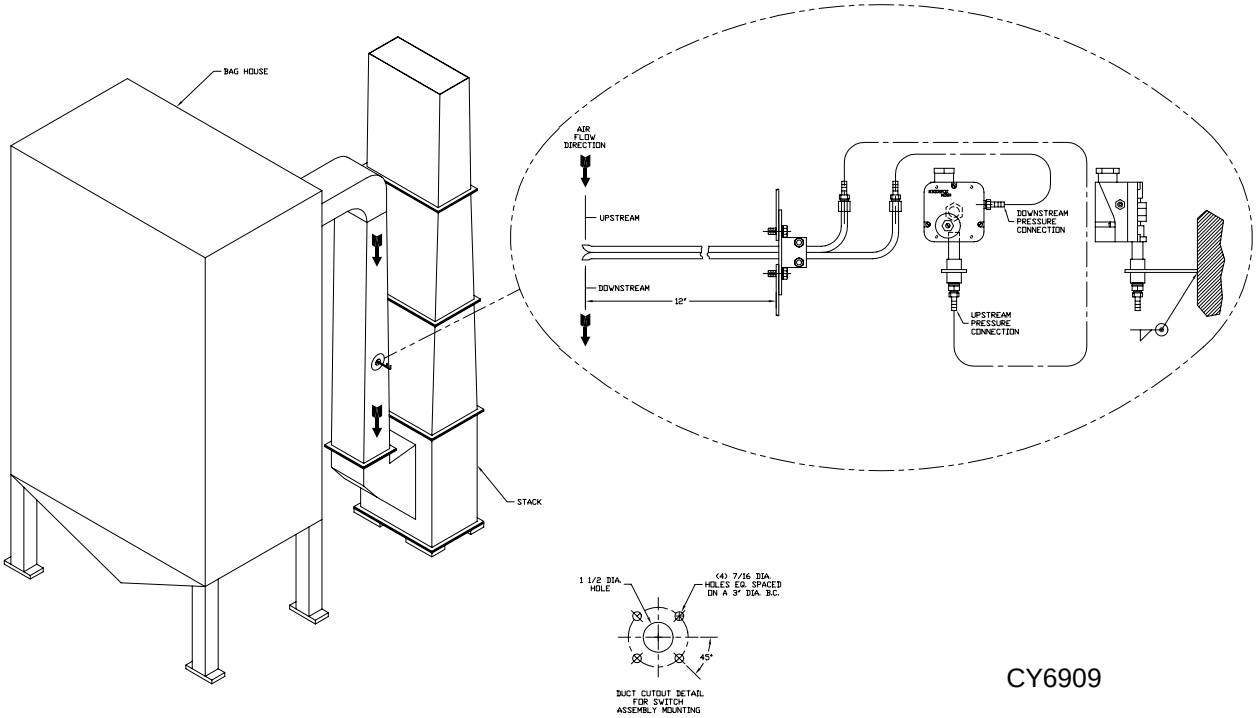
The **STACK** alarm setpoint is factory set at 400 °F (204 C). If the system is equipped with a fabric dust collector (baghouse), consult the manufacturer for recommended baghouse temperature limitations.

Press the **SETUP** key to step through the other setup parameters and confirm the following values:

	Fahrenheit		Centigrade	
	Type J	Type K	Type J	Type K
Lower Display	Upper Display	Upper Display	Upper Display	Upper Display
Filt	2.0	2.0	2.0	2.0
HySt	1	1	1	1
rOPH	842	1399	450	760
rOPL	32	32	0	0
diSP	1	1	1	1
h_A1	841	1399	450	760
L_A2	32	-328	0	-200
Loc	0	0	0	0

APPENDIX F: EXHAUST FAN FLOW LIMIT SWITCH INSTALLATION

Mount the exhaust fan flow switch in the dryer exhaust duct as shown below.

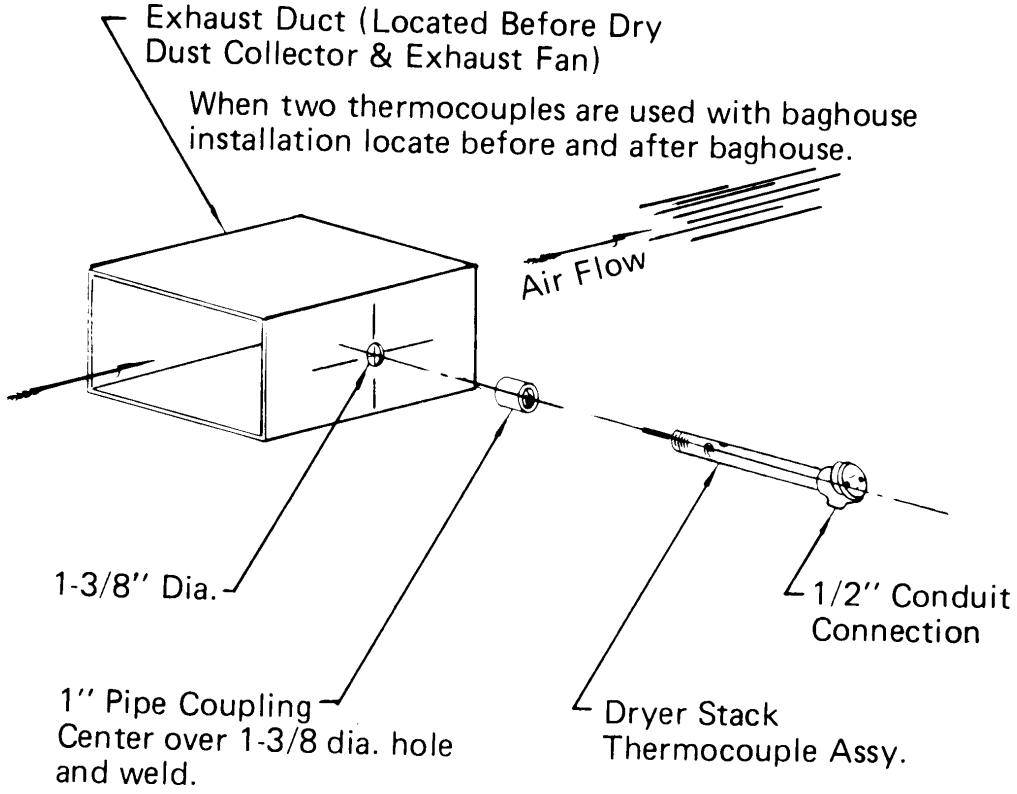


Drawing showing the installation
of the exhaust fan flow switch.

Wire the exhaust flow switch to the appropriate terminals. The exhaust flow switch is an interlock which requires the exhauster to be operating prior to ignition of the burner.

APPENDIX G: STACK THERMOCOUPLE INSTALLATION

Install a Hauck stack temperature thermocouple in the dryer exhaust duct to sense exhaust gas temperatures.


Exhaust Duct (Located Before Dry Dust Collector & Exhaust Fan)
When two thermocouples are used with baghouse installation locate before and after baghouse.
Air Flow
1-3/8" Dia.
1/2" Conduit Connection
1" Pipe Coupling Center over 1-3/8 dia. hole and weld.
Dryer Stack Thermocouple Assy.

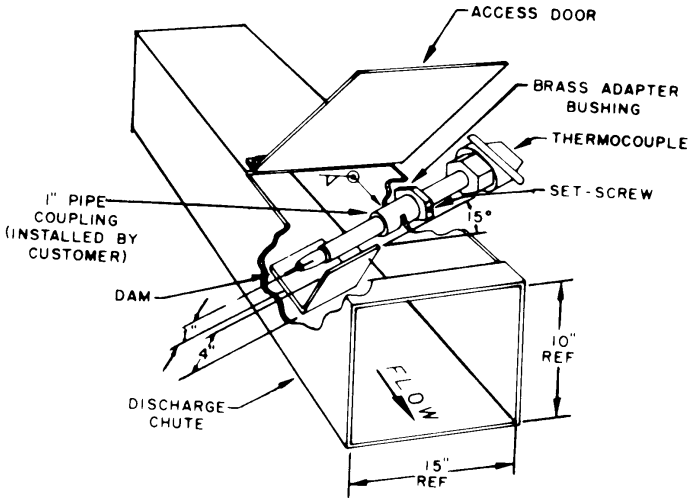
Drawing showing placement of thermocouple in exhaust duct.

NOTE

Thermocouple cables must be separated from AC power and control wiring to avoid interference and nuisance shutdowns. Observe polarity when making thermocouple connections. Regardless of TC type, the red wire is always negative.

APPENDIX H: MATERIAL THERMOCOUPLE INSTALLATION

Install a Hauck Rapid Response Material Temperature Thermocouple in the material discharge chute to sense the temperature of the material leaving the dryer. Wire the thermocouple to the proper terminals in the panel.



Drawing showing the placement of the thermocouple and "dam" in the dryer discharge chute.

IMPORTANT

A small clearance (1" maximum) should be provided under the thermocouple so material will not be trapped between the thermocouple and the chute. Trapped material will cause a heat loss path and the thermocouple will give erroneous readings.

The thermocouple should make good contact with the material but not be subject to severe abrasion caused by high velocities. If the material is moving so fast that it bounces and leaves air adjacent to the thermocouple, the temperature it senses will be lower than the material. It may be necessary to place a dam in the chute so that the thermocouple is in a relatively slow moving area next to the dam. The dam must only be wide enough and high enough to create a localized area of build-up where the material loses velocity BUT DOES NOT STOP FLOWING. The thermocouple must not be located in a stagnant zone or erroneous temperature readings will result. Because of the large number of variables involved, it is impossible to set down any exact size or location of the dam that will always work. Field experimentation will be necessary if good results are to be obtained. It is advisable to tack weld the dam in place so that it can be easily modified if it fails to perform satisfactorily.

NOTE

During normal operation, the thermocouple should be rotated once a month to expose a different area of its surface to the abrasive forces of the material. This procedure will increase the effective life of the thermocouple. If excessive wear occurs, a protective tube may be added to shield the shaft in the region of the high velocity flow.

NOTE

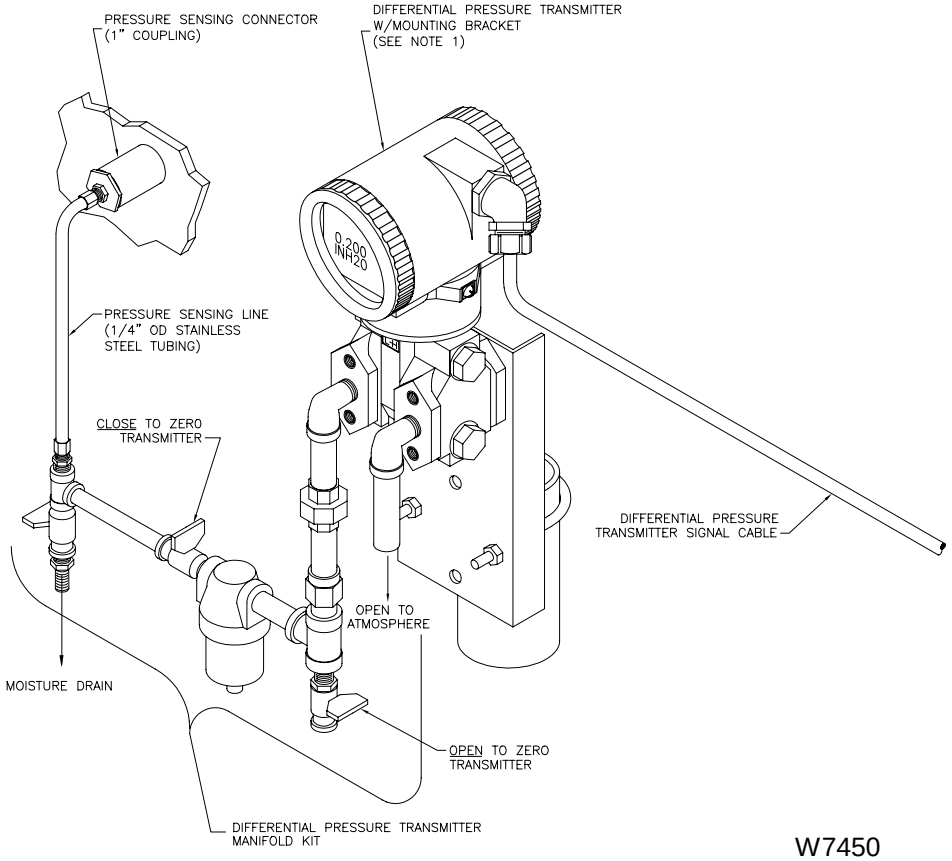
Thermocouple cables must be separated from AC power and control wiring to avoid interference and nuisance shutdowns. Observe polarity when making thermocouple connections. Regardless of TC type, the red wire is always negative.

APPENDIX I: DRAFT TRANSMITTER ADJUSTMENTS

The **NEXT** and **ENTER** buttons located below the Lcd display may be used to adjust or reconfigure the draft transmitter if required. Wait 1 or 2 seconds between each button press to allow the display to update.

ZEROING

Allow the unit to warm up for at least 5 minutes before adjusting the transmitter zero. Reference the drawing below and use the shutoff cocks in the transmitter manifold to isolate the transmitter from the dryer and to open the LOW pressure tap to atmosphere.



NOTES:
1. FOR DRYER DRAFT APPLICATIONS, CONNECT PREPIPED MANIFOLD TO 'LOW' PRESSURE TAP (AS SHOWN).
2. 1/4" OD STAINLESS STEEL TUBING TO BE CUT TO REQUIRED LENGTH BY CUSTOMER.

Transmitter and Manifold Layout

If the transmitter display does not read 0.00 IN H2O use the following procedure to zero the transmitter.

- Press the **NEXT** button one time to change the lower display to **CALIB**.
- Press **ENTER** to change the lower display to **CAL AT0**.
- Press **ENTER** and the lower display will read **AT0 DONE**.
- Press **NEXT** to step through the remaining calibration options until the lower display reads **SAVE**.
- Press **ENTER** to save the new zero calibration and exit the calibration mode. Note that calibration changes can be discarded by pressing **ENTER** when the lower display reads **CANCEL** instead of **SAVE**

4 MA ADJUSTMENT

Verify that when the transmitter reads 0.00, the BCS 6000 touchscreen display also reads 0.00.

If necessary, adjust the transmitter 4 mA value using the following procedure.

- Press the **NEXT** button one time to change the lower display to **CALIB**.
- Press **ENTER** to change the lower display to **CAL AT0**.
- Press **NEXT** until the lower display reads **ADJ 4MA**.
- Press **ENTER** and the lower display will read **A 4MA ^^.**
- If the DPS display reads less than 0.00, increase the 4 mA calibrations as follows:
    - Press **NEXT** to change the lower display to **A 4MA ^.**
    - Each press of the **ENTER** button will slightly increase the transmitter output and the DPS display should increase until it reads 0.00.
- If the DPS display reads greater than 0.00, decrease the 4 mA calibrations as follows:
    - Press **NEXT** to change the lower display to **A 4MA v.**
    - Each press of the **ENTER** button will now slightly decrease the transmitter output and the DPS display should decrease until it reads 0.00.
- Press **NEXT** to step through the remaining calibration options until the lower display reads **SAVE**.
- Press **ENTER** to save the new zero calibration and exit the calibration mode. Note that calibration changes can be discarded by pressing **ENTER** when the lower display reads **CANCEL** instead of **SAVE**

CONFIGURATION PARAMETERS

The transmitter has been factory configured and should not require any field modifications. The following parameter settings are provided for reference only.

PARAMETER	LOWER DISPLAY	UPPER DISPLAY
External Zero (Not applicable)	EX ZERO	EXZ DIS
Output Direction	OUT DIR	FORWARD
Output Mode	OUTMODE	LINEAR
Output Failsafe	OUTFAIL	FAIL LO
Signal Dampening	DAMPING	NO DAMP
Display Engineering Units	DISP EGU	USE EGU
Select Engineering Units	EGU SEL	INH2O
Lower Range Value	EGU LRV	00.00
Upper Range Value	EGU URV	1.00, 3.00 or 5.00